

Evaluation of Orexin-A serum levels in karate athletes cohort

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ABSTRACT

The lateral hypothalamus products various neuropeptides, among of these the Orexin-A (hypocretin-1) is a protein that regulates numerous physiological and behavioural processes involving in energy balance and metabolic status, physical activity, blood glucose levels, and food intake. Many data literature reported that the production of Orexin-A increases following regular and structured physical activity. Indeed, it improves energy metabolism and insulin sensitivity, and also modulate energy expenditure and thermogenesis. The higher Orexin-A tone is an endogenous factor that predicts physical activity, improving BMI and the energy expenditure aspect. It is well known that physical activity has positive effects on health and body weight, it improves cognitive performance increasing Orexin-A levels. Given these evidences, the aim of this study is evaluated Orexin-A serum levels in a cohort of karate athletes. For these reasons, were recruited 10 young karate athletes and 10 matched non-athletes as control. We evaluated biochemical and anthropometric parameters, and Orexin-A serum levels through ELISA-test. Our results showed that there is a statistical difference between karate athletes and non-athletes in BMI and in biochemical parameters such as glycaemic and lipid profile. Interestingly, Orexin-A serum levels are statistical higher in karate athletes compared to non-athletes. The differences between athlete and non-athletes in this study could be attributed to a better training-related hypothalamic activity in karate athletes. In addition, these evidences indicate that the physical activity has beneficial effects not only on anthropometric and biochemical parameters but also on orexin-A levels, and then on central nervous system.

Keywords: Orexin-A; Central nervous system; Karate athletes; Physical activity.

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INTRODUCTION

Orexin-A/Hypocretin 1, is a neuropeptide synthesized in the lateral hypothalamus (Messina et al., 2016; Sperandeo et al., 2018). It plays an important role in the regulation of appetite, in addition several studies reported that an intracerebroventricular injection of Orexin-A modifies eating behaviour, increasing heart rate, blood pressure, and metabolic rate (Chieffi et al., 2017a; Inutsuka and Yamanaka, 2013a; Messina et al., 2015). Orexin-A is involved also in stimulation of food intake, hunger and hypoglycaemia, it plays an important role in the regulation of metabolic status (Messina et al., 2014; Messina et al., 2018). Orexin-A modulates energy metabolism, excitement, and physical activity, playing a pivotal role fighting obesity, increasing physical activity, and thermogenesis during non-exercise activities, as well as energy expenditure (Sakurai, 2014). In mouse model studies show that the injection of Orexin-A in the lateral hypothalamus induced weight loss, developing a greater propensity for spontaneous physical activity, increasing energy expenditure and diminishing food intake (Clark et al., 2009; Diniz Behn et al., 2010; España et al., 2007). Also, in human Orexin-A has many beneficial effects, on metabolic status reducing glycemia and modulating lipid profile, and also stimulating spontaneous physical activity. Many data literature reported that the production of Orexin-A increases following regular and structured physical activity. Indeed, it improves energy metabolism and insulin sensitivity, and also modulate energy expenditure and thermogenesis. The higher Orexin-A tone is an endogenous factor that predicts physical activity, improving BMI and the energy expenditure aspect. It is well known that physical activity has positive effects on health and body weight, it improves cognitive performance increasing Orexin-A levels. Karate is one of the most popular martial arts practiced worldwide. Karate contains two main practices (i.e., *kata* and *kumite*). *Kata* represents a demonstrating pre-arranged form of methods of defence, attack, and counterattack. In this training, a performance of set sequences of basic techniques in a fight with an imaginary opponent is performed. *Kumite* represents the process of sparring utilizing karate skills performed by two opponents. *Kumite* requires the karateka, a rapid choice of the adequate action pattern to defence and attack (Moscatelli et al., 2016). High technical skills (i.e., kick and punch) are required in fight (i.e., *kumite*) and high levels of precision and velocity are needed to execute the right movements for attack and defence (Moscatelli et al., 2016). In addition, cognitive abilities and efficient attentional processes influence the technical performance in karate allowing more time for the organization of motor behaviour; furthermore, quick and correct responses are ensured to visuospatial stimuli (Moscatelli et al., 2016). Given these evidences, the aim of this study is evaluated Orexin-A serum levels in a cohort of karate athletes (Catenacci and Wyatt, 2007; Cox, 2017; Monda et al., 2019) showing the beneficial effects of physical activity has beneficial effects not only on anthropometric and biochemical parameters but also on orexin-A levels, demonstrating the important role of central nervous system in karate athletes.

MATERIAL AND METHODS

10 karate athletes and 10 matched non-athletes were recruited. All procedures were conformed to the directives of the Declaration of Helsinki and were approved by the Institutional Ethical Committee of the University of Foggia. The athletes were Caucasian karate black belts. They competed at national and international levels; they trained at least five 2-h sessions every week during the previous 5 years. Fasting blood samples were collected at 8:00 am from an antecubital vein, using a 21G Vacutainer blood collection set (BD Diagnostics, Franklin Lakes, NJ, USA). Blood samples were centrifuged and the resultant serum stored at -80 °C, until use.

Biochemical assay

As previously described serum orexin-A concentrations were determined by enzyme-linked immunoassay (ELISA), using a commercial kit, according to manufacturers' instructions (Phoenix Pharmaceuticals, USA).

Briefly, Sep-Pak C18 columns (Waters, Milford, MA, USA) were utilized to extract orexin-A from karate athletes and non-athletes. (Valenzano et al, 2019).

Statistical analysis

Statistical analyses were performed using the StatView software 5.0.1.0. All data are presented as mean \pm SE. A p value of $\leq .05$ was used for statistical significance.

RESULTS

We found a significant difference between karate athletes and non-athletes subjects. In particular, as show Table 1, karate athletes have a better anthropometric and biochemical profile (Table 1). Furthermore, there is a strongly modulation of all biochemical parameters, such as glycaemic and lipid profile. Interestingly, as show ELISA test Orexin–A levels in karate athletes is statistical higher compared to non-athletes subjects (Figure 1).

Table 1. Anthropometric and biochemical parameters of karate athletes vs non-athletes.

	Non-athletes (10)	Karate Athletes (10)
Age	27.9 \pm 1.5	28 \pm 2.5
BMI	25 \pm 4.5	23.3 \pm 3.5 **
Total Cholesterol	170 \pm 9	159 \pm 8.7 **
LDL (mg/dL)	110 \pm 5.4	90 \pm 3.7 **
HDL (mg/dL)	54 \pm 2	56 \pm 2.8
Triglycerides (mg/dL)	95 \pm 2.3	89 \pm 3.5
Glucose (mg/dL)	97 \pm 6.5	79 \pm 5.5 **

Note: ** p-value < .05.

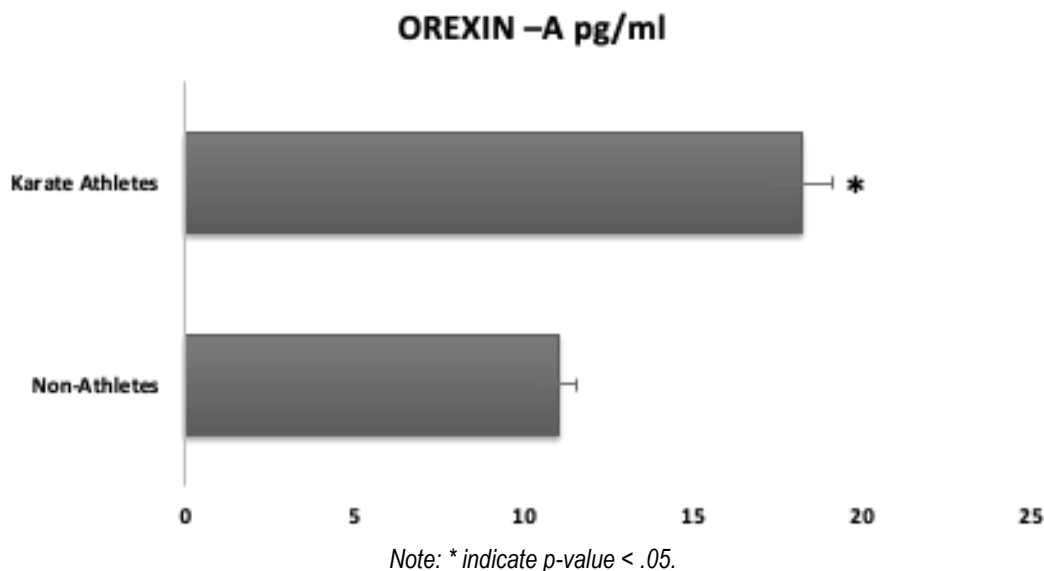


Figure 1. Orexin-A serum levels statistical higher in karate athletes compared to non-athletes subjects.

DISCUSSION

Karate is one of the most popular martial arts practiced worldwide. Karate contains two main practices. This sport is composed by physical and cognitive factors. Indeed, are required technical skills and high levels of precision and velocity. In addition, the performance may be influenced by cognitive abilities and efficient attentional processes (Bianco et al, 2018; Francavilla et al, 2017; Messina A. et al, 2018; 2017; 2016; Sessa et al., 2018). Also, it is well know that the physical exercise protects against cardiovascular, bone and joint, and metabolic disorders such as diabetes and that it is an effective means in the prevention and treatment of certain types of cancer (Francavilla C et al, 2013, Francavilla et al, 2015; Messina G. et al 2015; Monda et al., 2019; Penna et al, 2019; Patti et al., 2017).

The physical activity has numerous beneficial effects, on cardiovascular performance and protects against many preventable diseases. In addition, during physical activity, there are some physiological adaptations that induced the production of important mediators such as Orexin-A. This neuropeptide is synthesized in the lateral hypothalamus (Messina et al, 2016; Eyman et al., 2013; Gonzalez et al., 2012). It has numerous beneficial effects on insulin sensitivity, energy expenditure and metabolic rate and is involved in immune processes and then regulate inflammatory response, with an anti- inflammatory action (Sperandeo et al, 2018, Monda et al, 2019; Giuditta et al, 2013; Moscatelli et al., 2015). In the light of these evidences, in this study we evaluated Orexin-A serum levels in a cohort of karate athletes compared to non-athletes. We found a strong difference in anthropometric and biochemical parameters between karate athletes and non-athletes subjects. In particular, a better glycaemic and lipid profile in athletes confirm the beneficial effects of physical activity (Cavaliere et al., 2019; 2018; Francavilla et al., 2018; Spagnolo et al., 2019; Ventura et al., 2018; Mondello et al., 2018). Also, the higher Orexin-A serum levels in karate athletes compared non-athletes subjects show the cognitive response induced by physical activity. Indeed as reported by Polito et al, the physical activity has positive effects on health and body weight and also it improves cognitive performance acting on Orexin-A production (Polito et al 2020, Colcombe et al., 2004, 2006; Erickson et al., 2011; Lindwall et al., 2008; Mazzeo et al., 2013; Sapienza et al, 2017; Gualniera et al., 2017; Maio et al., 2020).

Therefore, orexin signalling might positively regulate feeding and arousal, but also motor activity and basal energy expenditure, resulting in resistance to weight gain (Vicchio et al., 2020; Guarnieri et al., 2020; Viggiano et al., 2009; 2016; Francavilla et al, 2007; 2018; 2016). Furthermore, the Orexin-A level is correlated with physical activity and low sedentary time. Higher Orexin-A tone is an endogenous factor that predicts physical activity, improving BMI and energy expenditure. In conclusion these evidences indicate that the physical activity has beneficial effects not only on anthropometric and biochemical parameters but also on orexin-A levels, and then on central nervous system. In addition, the Orexin-A may be beneficial cognitive effects in karate sport but further studies are needed to clarify this action.

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